ments are not yet finished, but the first, which was made on January 22, 1896, seems to leave no doubt on one point of the investigation.

A ∩-tube was taken, and at the bend was fixed a plaster of Paris plug about 1·5 cm. thick; in one of the limbs two platinum wires were inserted. The plug was saturated with hydrogen to free it from air; the tube was then plunged into a mercury trough, and fixed upright with the limbs full of mercury. Into the leg (A) with the platinum wires a small quantity of hydrogen was passed, and as soon after as possible another small quantity of a mixture of helium and hydrogen from samarskite was put up the other limb (B) of the ∩-tube.

Immediately after the helium was passed into the limb (B), spectroscopic observations were made of the gas in the limb (A); D_3 was already visible, and there was no trace of 5015·7. This result seems to clearly indicate that if a true diffusion of one constituent takes place, the component which gives D_3 is lighter than the one which gives the line at wave-length 5015·7.

Although this result is opposed to the statement made by Runge and Paschen, it is entirely in harmony with the solar and stellar results. In support of this I may instance that of the clèveite lines associated with hydrogen in the chromosphere, and the stars of Group IIIγ, those allied to D_3 are much stronger than those belonging to the series of which 5015·7 forms part.

IX. "Problems in Electric Convection." By G. F. C. Searle, M.A. Communicated by Professor J. J. Thomson, F.R.S. Received March 16, 1896.

(Abstract.)

The paper contains an investigation into the distribution of electric and magnetic forces which are called into play when some electromagnetic systems are made to move with uniform velocity through the ether. Maxwell's theory is employed in obtaining the fundamental equations, and it is found that though the electric and magnetic forces, E and H, have generally no potential, still they can be derived from two functions Ψ and Ω; the differential equations satisfied by these functions are obtained. The equations are first employed to obtain the solution for a moving point-charge, and the result is identical with that obtained by Heaviside and J. J. Thomson. The mechanical forces F and R experienced by a unit charge and a unit pole respectively when moving forwards with the rest of the system are next investigated, and found to have true potentials, Ψ and Ω, the same functions as those mentioned above. These func-

tions are called the electric and magnetic convection potentials respectively.

The conditions which are necessary in order that the electricity may be relatively at rest on any surface on which it is being conveyed are next investigated, and it is shown that it is not the electric force E, but the mechanical force F, which must be normal to the surface. The equilibrium surfaces are therefore given by Ψ = constant. The mechanical stress on the moving charged *surface* has a tangential component, and for certain directions of the normal may have a normal component *inwards*, provided that u/v exceeds 0·810465, where u is the velocity of the system and v the velocity of light.

The energy of a moving electrical system takes the form $2T+\frac{1}{2}\Sigma q\Psi$, where T is the total magnetic energy and Ψ is the value of the electric "convection potential" at the charge q.

The ellipsoid of revolution which is given by Ψ = constant, where Ψ is the value of the electric "convection potential" for a point-charge moving at the same speed, is called the "Heaviside" ellipsoid. A complete solution is given for the case in which this ellipsoid is electrified and is moving along its axis of figure. At all external points it produces the same effect as a point charge at its centre would do.

For an ellipsoid of any shape it is shown that the distribution of electricity over its surface is the same whether the ellipsoid be at rest or in motion.

Finally, a complete solution is given for an ellipsoid of revolution in motion along its axis of figure. If the ellipsoid (a, b, c) is moving along one of its axes (a), the surfaces of equal "convection potential" are given by

$$\frac{x^2}{a^2+\alpha\lambda}+\frac{y^2}{b^2+\lambda}+\frac{z^2}{c^2+\lambda}=1,$$

where $\alpha = 1-u^2/v^2$ and λ is a variable parameter. When $b = c$ the lines of electric force are given by the hyperbolic members of the family of curves given by

$$\frac{x^2}{a^2+\alpha\lambda}+\frac{\rho^2}{b^2+\lambda}=1,$$

where $\rho^2 = y^2+z^2$.

The ellipsoid produces the same field as either a uniformly charged line or a charged disc placed symmetrically inside the surface, according as the ellipsoid is more prolate or more oblate than Heaviside's. For a sphere of radius a the length of the line is $2au/v$. The energy of the ellipsoid is calculated, and the result for a sphere of radius a carrying a charge q is found to be

$$\frac{q^2}{2\kappa a}\left(\frac{v}{u}\log\frac{v+u}{v-u}-1\right),$$

where κ is the specific inductive capacity of the medium.